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Freshwater management: progress in meeting the goals, targets and commitments of Agenda 21, the Programme for the Further Implementation of Agenda 21, and the Johannesburg Plan of Implementation

Report of the Secretary-General

Summary

Consideration of freshwater management in Agenda 21 and the Johannesburg Plan of Implementation focuses on two issues: safe drinking water and integrated water resource management. Improving access to safe drinking water has been identified as a high development priority both in the Millennium Declaration and the Johannesburg Plan of Implementation.

Contaminated drinking water is a major source of illness and death in developing countries. During the 1990s, the number of people with access to improved drinking water** increased by about 900 million, from 78 per cent of the global population to 82 per cent. More than 80 per cent of those without access live in rural areas. Many countries in Asia are on track to meet the target of halving the number of people without access to safe drinking water by 2015, but in other regions, most countries are not on track. Meeting the target will require providing access to an additional 1.6 billion people by 2015, which is estimated to require a doubling of spending on drinking water supply. Contaminated water sources, inadequate maintenance of pumps and distribution systems, and leakage of water from pipes are problems that need to be overcome. Some countries are improving the financing of water supply through increased cost recovery from those who can afford to pay, with subsidies for those who cannot. Public-private partnerships for urban water supply are being explored with mixed results.

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In developing countries, most freshwater is used for agricultural irrigation, while in developed countries the largest user is industry. In both sectors, there is a large potential for increased efficiency in use, as well as reductions in pollution. Many countries have been strengthening their integrated water resource management processes, with decentralization of some aspects of water management and increased participation of local users or water user associations and other stakeholders. In many cases, this has resulted in improved water allocations, greater efficiency of use, and greater cost recovery. In the growing competition for water, the water requirements of aquatic ecosystems have been largely neglected, resulting in a deterioration of the valuable economic, social and environmental services they provide. Strengthening integrated water resource management will also require measures to reduce water-related disasters, which are a major cause of human suffering and economic damage.

** For the definition, see paragraph 10 of the report.

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I. Background

1. The present report on freshwater development and management presents an updated review of the state of implementation of the goals and targets agreed upon in Agenda 21, the Programme for the Further Implementation of Agenda 21 and the Johannesburg Plan of Implementation of the World Summit on Sustainable Development. The report also highlights constraints and obstacles that countries have encountered in the implementation of these goals and targets, and reflects continuing challenges in the implementation process. The report in particular reviews the progress made and issues related to the implementation of the following goals and targets:

- To halve, by the year 2015, the proportion of people without access to safe drinking water
- To develop integrated water resources management and water efficiency plans by 2005, with support to developing countries
- To stop the unsustainable exploitation of water resources by developing water management strategies at the regional, national and local levels, which promote both equitable access and adequate supplies
- To promote effective coordination among the various international and intergovernmental bodies and processes working on water-related issues, both within the United Nations system and between the United Nations and international financial institutions.

2. An analysis of the following sources provided the main body of data and information presented in the present report:

- Country reports and national assessments submitted by Governments to the secretariat of the Commission on Sustainable Development
- Reports and contributions received from other United Nations agencies, including FAO, IAEA, UNDP, UNEP, UNESCO, UNICEF, WHO, the World Bank, and the secretariat of the International Strategy for Disaster Reduction
- Regional assessments prepared by the United Nations regional commissions
- The *World Water Development Report*.

3. In addition to the goals and targets agreed in the Millennium Declaration and the Johannesburg Plan of Implementation, progress is also judged against the cross-cutting issues as identified by the Commission at its eleventh session in its future work programme. Progress on two other issues related to water — sanitation and human settlements — is reviewed in two separate reports.

II. Introduction

4. Agenda 21, the Programme for the Further Implementation of Agenda 21 and the Johannesburg Plan of Implementation recognize water resources as a critical factor in sustainable development. In recent years, however, there has been growing concern over a "global water crisis" resulting from increasing demand for finite water resources, contamination of water supplies, and degradation of ecosystems due to mismanagement of water. Underlying those factors are continuing population

growth, urbanization, industrialization and intensification of agriculture. It is recognized that water will be a critical factor in development strategies for the future, particularly in the growing number of areas where water resources are already scarce relative to the population.

5. Agenda 21 and the Johannesburg Plan particularly emphasize the importance of increasing access to safe drinking water and sanitation as a central element of poverty reduction efforts. In the Millennium Declaration and the Johannesburg Plan, time-bound targets provide further impetus to the implementation of that commitment.

6. Most analyses indicate that the "water crisis" is primarily an institutional problem reflecting lack of capacity, finance and political will to manage water resources and provide water services, rather than a water crisis as such. Knowledge, skills and technologies exist for managing water resources and providing water services for all in support of sustainable development. The present report reviews the challenges facing countries in the management of their water resources and some of the solutions that countries have found in responding to those challenges.

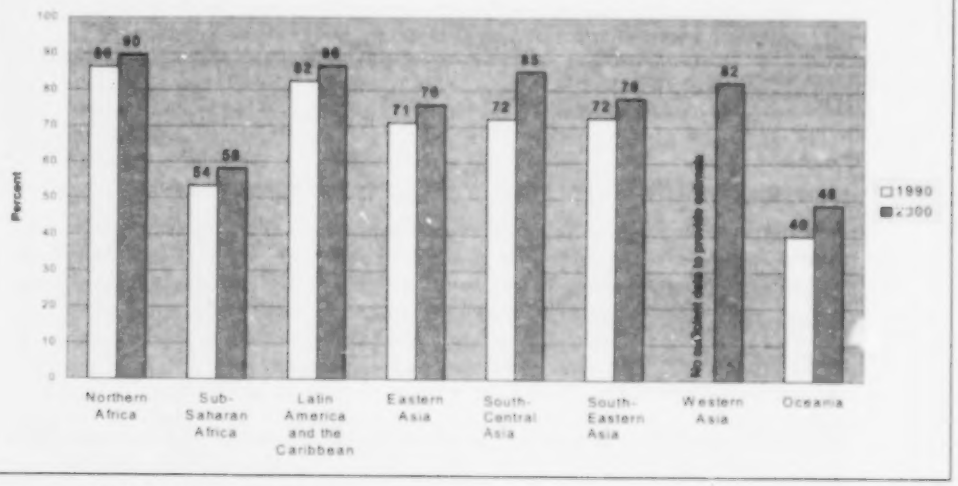
III. Drinking water supply

A. Access to safe drinking water

7. During the 1990s, the number of people with access to improved drinking-water supply increased by 900 million (535 million in urban areas and 365 million in rural areas), from 78 per cent of the global population in 1990 to 82 per cent in 2000, taking into account population growth. The increase was from 57 per cent to 62 per cent in Africa, 76 per cent to 81 per cent in Asia, and 82 per cent to 85 per cent in Latin America and the Caribbean. While that represents significant progress in all of those regions, the rate of increase is in most cases well below the rate required to meet the Millennium Declaration and 2015 target of the Johannesburg Plan, Asia being the exception. In Western Europe and North America, virtually 100 per cent of the population has improved drinking-water supplies. In Eastern Europe and the former Soviet Union, a significant number of people, particularly in rural areas, do not have access, but the numbers and trends have not been accurately measured.

8. The greatest gains in access to drinking water in the 1990s (see figure 1) were registered in South Asia, from 72 per cent to 85 per cent of the population, particularly due to major progress in India, Nepal, Pakistan and Sri Lanka. South Asia is therefore on track to meet the 2015 target. The lowest access rates remain in sub-Saharan Africa and Oceania, where only 58 per cent and 48 per cent of the population, respectively, have access. The challenge in sub-Saharan Africa is more complex owing to large displaced and refugee populations, countries in conflict or in reconstruction, and the HIV/AIDS pandemic.

Figure 1: Access to improved drinking water sources



Source: WHO/UNICEF: Joint Monitoring Programme, 2001.

9. In all developing regions, there are wide disparities in access to improved drinking water between urban and rural populations (table 1). Although rural areas saw greater improvements in the 1990s than urban areas — a 7 percentage-point increase in access compared with 1 percentage point — they started from a much lower base, and rural areas remain poorly served in drinking-water supply. In 2000, more than four out of five people without access to improved drinking water lived in rural areas. Urban-rural disparities are greatest in sub-Saharan Africa, where only 45 per cent of the rural population has access as opposed to 83 per cent of the urban population. In East Asia and in Latin America and the Caribbean, the urban-rural disparity is almost 30 percentage points. Those disparities exist despite the fact that it is generally less expensive to provide rural households with improved access — usually by a borehole or well — than it is to provide urban households, usually with a household piped connection or public standpipe connected to the municipal water supply. The typical cost of a borehole or well in developing countries is about $20-$50 per person served, compared with $100-$140 for a piped household connection, and $30-$60 for a standpipe.[1]

Table 1
Population without access to improved drinking water, 2000
(In percentage)

Region	*Urban*	*Rural*	*Overall*
Sub-Saharan Africa	17	55	42
North Africa	5	16	10
West Asia	11	29	18
South Asia	5	20	15
East Asia	6	34	23
South-East Asia	9	29	22
Latin America and the Caribbean	6	35	13
Developing countries overall	8	31	21
Least developed countries	18	45	38
Eastern Europe/former Soviet Union	5	18	9
OECD countries	0	0	0

Source: WHO/UNICEF Joint Monitoring Programme, www.wssinfo.org, 6 February 2004.

Box 1
Progress and constraints: regional snapshots

Africa: Sub-Saharan Africa has a lower rate of access to improved drinking water than other regions. The lack of progress is primarily due to inadequate water management capacities, not scarcity of freshwater. Partly as a result of contaminated drinking water and poor sanitation, the under-5 child mortality rate in Africa is higher and has declined less over the 1990s than in any other region. The Democratic Republic of the Congo, home to the largest hydrological potential on the continent, reported a decline in the number of people with access to improved drinking water. In contrast, the United Republic of Tanzania achieved a 30 percentage-point increase in water access over the 1990s.

Asia: Access to safe drinking water is still inadequate in parts of Asia, but several countries, notably in South Asia, have made significant progress in extending coverage during the 1990s. Others — including Bhutan, Timor-Leste, Cambodia, and Mongolia — need special attention to make progress towards the targets. A number of countries report comprehensive monitoring programmes for water quality, including China, India, Japan and Singapore.

West Asia: Progress has been made in the region in expanding water distribution networks, but there are still difficulties in providing access for all to safe water and sanitation and improving wastewater management, particularly in rural areas. In Lebanon, Jordan and Saudi Arabia, 100 per cent of the urban population has access to drinking-water supply, while other countries, such as Yemen and Oman, have not been making sufficient progress to meet the target.

Latin America and the Caribbean: In terms of safe drinking water and sanitation, access is relatively high — 80 per cent for safe drinking water and 59 per cent for sanitation. However, all countries report great disparities in services between rural and urban areas. In 2000, 94 per cent of the urban population had access to improved water services, but only two thirds of the rural population.

Source: National Reports submitted to the Commission on Sustainable Development in 2002.

10. The proportion of the urban population in developing countries reported to have access to an improved water source was 92 per cent in 2000. By the Joint Monitoring Programme definition, "improved" refers to a household connection, public standpipe, borehole, protected dug well, protected spring, or rainwater collection. Excluded are unprotected wells and springs, vendor-provided water, and tanker truck water.[2] The percentage seems impressive when set against the estimated 924 million people living in slums (see the companion Human Settlements Report), roughly one third of the world's urban population in 2000. It suggests that a high proportion of slum dwellers do have access to an improved water source. Many utilize standpipes or boreholes, and even those who buy water from vendors or tanker trucks may indirectly obtain it from an improved source.

11. While the data available for trends in drinking-water supply are for "improved" sources, safe drinking water also depends on the quality of the water at source. Contamination of water sources by human or animal waste, industrial waste, or natural toxic elements, such as arsenic, can render water unsafe for drinking even though it comes from an improved source. In general, there is not enough data to determine the levels or trends in access to water of a quality safe for drinking. Many cities in developing countries report that municipal drinking water often does not meet national standards for microbiological, chemical, physical or aesthetic quality. In Africa, about 36 per cent of drinking-water quality tests show violation of national standards, in Asia about 22 per cent, and in Latin America and the Caribbean about 18 per cent.[3]

12. The definition of access does not adequately capture the quality of service. In many countries, service delivery by existing water supply systems is inadequately maintained. Over one third of the urban water supplies in Africa, Latin America and the Caribbean, and more than half of those in Asia, operate intermittently. Also, many urban drinking-water systems do not treat water: one in five systems in Africa, Asia, and Latin America and the Caribbean, and two in five systems in the small islands of Oceania.

13. Water losses and leakages in urban water supply systems remain high in both developed and developing countries (see Box 2 for an example of progress in reducing water losses). Average unaccounted-for-water is around 39 per cent for large cities in Africa, 35-42 per cent for large cities in Asia, and 40 per cent for large cities in Latin America.[4] Figures for unaccounted-for-water in some water-stressed cities are even higher: 51 per cent in Algiers and 52 per cent in Amman in the 1990s.[5] Poor operation or deferred maintenance of the systems, budgetary constraints, lack of cost-recovery mechanisms, weak governance, and deficient institutional frameworks remain leading causes for the poor performance of water

supply systems. Considerable potential exists to reduce those losses through improved maintenance, better financing through cost-recovery, improved governance and management of utilities, and public awareness raising.

Box 2
Reducing unaccounted-for-water in Spain

The city of Murcia, Spain, with a population of 350,000, was faced with a high level of unaccounted-for-water of 44 per cent. By implementing a new commercial management system that better accounted for all water uses and users, the municipal water company reduced unaccounted-for-water to 23 per cent over five years. The resulting water savings allowed an increase in the number of water connections by 19,000 resulting in 100 per cent coverage.

Source: Yepes, G. (1995), cited in *Water Resources and Environment*, World Bank, 2003.

14. The condition of rural water systems is also often poor. A recent survey in rural Niger, for example, indicates that 35 per cent of the hand pumps are non-functional and 32 per cent of the small piped systems are in poor condition, yet they are still included in national statistics as "safe" water points — as they are for many other African countries.[6] Those systems suffer from deferred repairs and maintenance and non-availability of spare parts. In the Punjab Province of Pakistan, some 13 per cent of the drinking-water supply schemes are non-operational owing to factors including inadequate operation and maintenance, deterioration of water quality due to over-pumping, and social conflicts.[7] Almost one third of the water supply system of Tajikistan is completely broken down. Poor donor coordination has contributed to degradation of service delivery. In Zambia, a survey found that there were over 40 different types of hand pumps scattered all over the country, resulting in high costs for spare parts, deficient operation and maintenance, and eventual abandonment of some of those systems.

15. Based on current urban and rural access rates, and using projected population figures,[8] UNICEF has estimated that between 2000 and 2015, an additional 1.6 billion people will need to gain access to improved drinking water in order to meet the internationally agreed target, over 60 per cent of them in urban areas (table 2).

Table 2
Additional access to improved drinking water needed to meet 2015 target
(Millions of people)

Region	*Urban*	*Rural*	*Total*
Sub-Saharan Africa	164	185	349
North Africa	50	35	85
West Asia	57	24	81
South Asia	221	257	478
Developing East Asia	259	40	299
South-East Asia	110	48	158
Latin America and the Caribbean	124	17	141
Developing regions total	**985**	**606**	**1 591**
Least developed countries	160	198	358
Eastern Europe/former Soviet Union	26	0	27

Based on WHO/UNICEF: Joint Monitoring Programme, www.wssinfo.org, 6 February 2004.

16. In each region, some countries are exceptional in their progress towards achieving the internationally agreed targets (see Box 3), including the Central African Republic, Congo, Ghana, Kenya, South Africa and the United Republic of Tanzania in sub-Saharan Africa; India, Nepal and Pakistan in South Asia; Viet Nam in South-East Asia; and Morocco and Tunisia in North Africa. Progress in those countries was due to increased funding from domestic and international sources, effective resource mobilization strategies through cost-recovery mechanisms, and integrated institutional frameworks, together with effective laws and regulations.

17. Frequently noted obstacles to the implementation of internationally agreed targets are inadequate financing, deficient cost-recovery policies, fragmented institutional structures, inadequate economic mechanisms in water sector management, environmental and ecological problems arising from lack of human settlement planning, and limited public awareness. In the case of Africa, those constraints are further compounded by higher water-development and distribution costs and weak technical and institutional capacities.

18. Owing to the increasing financial and environmental costs of developing new sources of water, it is generally more cost-effective to increase the effective water supply by reducing leakage and losses. Another cost-effective approach to improving water supplies is rainwater harvesting, which has been neglected as a source of drinking water partly because of water-quality concerns. It is now gaining popularity in many developing countries in Asia, including China, Thailand, India and Sri Lanka, as it provides a sustainable solution to water scarcity.[9] Desalination of sea water is used to provide water for drinking or other high-value uses in some water-scarce West Asian countries and small island developing countries, but the high cost limits the application of desalination as a source of water in poor countries or for relatively low-value uses such as irrigation.

Box 3
Factors influencing progress

Examples from around the globe offer some best practices that might be adapted or replicated to accelerate progress, as well as challenges and constraints that impede implementation. For example, in India, between 1980 and 2000, access to improved drinking-water supply nearly tripled. Progress in sanitation access, though less remarkable, was steady mainly due to technological progress together with emphasis on quality control, operation and maintenance of equipment, and the promotion of good hygiene. Strong political commitment reflected in increased allocation of budgetary resources, and innovative partnerships among non-governmental organizations, government and communities were the key factors driving progress. In Ethiopia, between 1990 and 2000, access to improved drinking-water supply increased by only 2 percentage points, to 24 per cent. In Ethiopia, of more than 6,000 rural water-supply systems serving 17 million people, some 30 per cent are not functional owing to poor maintenance of infrastructure. Other factors inhibiting water services are high project-implementation costs and low investments in the sector. In Chile, almost universal coverage has been achieved in household connections to piped water supply and sewers, and progress has been made in wastewater treatment. The service is generally of high quality, the water companies are financially sound, and targeted subsidies help to ensure access by low-income groups.

Source: National Reports submitted to the Commission on Sustainable Development in 2002.

B. Equity and affordability

19. The cost of supplying safe drinking water is increasing owing to a number of factors, including increased distance of new sources from consumers, increased investments associated with more efficient water-delivery systems, and increased treatment requirements to address water contamination. Mobilizing resources to meet the growing costs of expanding access, for both investments and operation and maintenance — particularly where water is subsidized — poses a major challenge. In the early 1990s, subsidies for drinking water and irrigation amounted to $45 billion per year in developing countries. However, there now appears to be a general trend towards water charges that recover more of the operation and maintenance costs.

20. Unless well targeted at low-income groups, subsidies can primarily benefit middle- and high-income urban consumers connected to the public water-supply network, whereas the urban poor, who are often not connected to the piped network, have to rely on more expensive sources of supply, such as private vendors. A recent survey of several large Asian cities found that the price charged by informal vendors is generally a multiple of the price of water from public utilities.[10] In Ghana, Guatemala, Mexico, and Peru, the richest 20 per cent of the population get about twice the amount of subsidized water services as the poorest 20 per cent.[11]

21. Water charges still remain far below the costs of water supply in many countries, especially in West Asia and North Africa. Monthly water bills in Egypt, for example, are as low as $1. Such low water charges are a disincentive for the private sector to invest in water infrastructure and for consumers to conserve water. To ensure that low-income households can afford water, there is a trend in urban water pricing towards "increasing-block" tariffs, where consumers pay a low rate for an initial small quantity for basic needs, then increasing prices for higher quantities. For the poorest households, however, even the lowest block tariffs may be expensive, and targeted subsidies for that group may continue to be needed. In many OECD countries, there has been a real increase in household water charges in recent years. Available evidence on affordability suggests that in about half the OECD countries, affordability of water charges for low-income households is either a significant issue now or could become so in the future if measures are not taken.[12]

22. With respect to private participation in the water sector, some evidence suggests that the poor have benefited: e.g., in three Latin American countries, following private participation, the poorest quintile of the population obtained between 25 per cent and 35 per cent of new connections.[13] Nonetheless, a more general review of the impact of infrastructure privatization on the poor in Latin America concludes that privatization generally failed to take the interests of the poor into account with regard to affordability of service and access to connections.[14] For poor households, the affordability of connection to the piped network is often a greater obstacle than the affordability of the water consumed, unless appropriate methods of financing the connection charges are introduced, such as instalment payments added to monthly water bills or low-interest loans.

23. Convenient access to an improved water source is particularly important to women and children living in rural areas, who often must haul water over long distances. That detracts from time and energy that could be applied to income generation and education (see Box 4).

Box 4

Water for entrepreneurial women in Pakistan

The Punjab Rural Water Supply Project has brought water to 325 poor and remote rural villages and transformed the lives of 800,000 people. Particular beneficiaries are women and children, who no longer have to carry water long distances. The project involved both women and men in all aspects of planning, design and implementation. Women, who previously spent two to six hours a day gathering water, found themselves with both extra time and extra energy, which was used for livelihood activities such as embroidery. Water-related diseases have been reduced by 90 per cent, household income increased by 24 per cent, and school enrolment increased by 80 per cent.

Source: http://www.adb.org/Documents/Events/2003/3WWF/ADB_cases.pdf#page=7.

C. Water quality and health

24. Globally, contaminated water is still responsible for approximately 7 per cent of all deaths and diseases, with 3-4 million people dying each year of waterborne diseases. Diarrhoea alone is responsible for 8.5 per cent and 7.7 per cent of all deaths in Asia and Africa, respectively. Considerable progress has been made in reducing that toll, with the total number of people dying each year of diarrhoeal diseases, most of whom are children, declining from 4.6 million in 1982 to 1.8 million in 2002, owing to improvements in drinking water, sanitation, hygiene and medical treatment, such as oral rehydration therapy.[15] The social costs of waterborne diseases caused by sewage pollution of coastal waters alone amounts to 4 million person-years lost per year, representing an economic loss of $16 billion a year.

25. One recent success in Africa has been major progress in the eradication of guinea worm disease through improved water and hygiene interventions, public awareness campaigns and improved monitoring networks. Reported cases dropped from 3,500,000 in 1986 to 75,000 in 2000, a decline of 98 per cent.

26. OECD countries have improved the quality of the water in major rivers in recent years after they had become seriously polluted. Advanced wastewater-treatment facilities for both municipal sewage and industrial effluent, cleaner industrial production processes, restrictions on agricultural chemicals, and less polluting materials, such as low-phosphate detergents, have improved the oxygen content of the water, reduced concentrations of metals, PCBs and other toxic chemicals, and increased the numbers and variety of fish. However, some toxic chemicals remain a challenge. Extensive data-collection systems provide regular and reliable information on water quality. On international rivers, such as the Rhine and Danube, international river commissions have been established to ensure concerted action.[16]

27. While the industrialized world has made huge investments in controlling wastewater discharges, 90 per cent of wastewater in the developing world still goes untreated into local rivers and streams.[17] Where wastewater-treatment facilities exist, they are usually unreliable and inefficient. Rivers of Nepal, Central Asia, China (Yellow River) and India (Ganges) are highly polluted (see Box 5). Those and other countries have started pollution-control programmes, including legislation, public awareness raising, community-based monitoring, and stronger enforcement mechanisms. Such efforts are under way in São Paulo, for example, to bring the biologically dead Tiete River back to life through sanitation and water treatment systems. Many aquifers are also polluted, especially beneath major cities of developing countries, but the degree is unknown. Another serious problem exists in Bangladesh and the State of West Bengal in India, where about 35 million people are at risk from drinking arsenic-contaminated groundwater of natural origin.[18]

28. In peri-urban areas in developing regions, untreated municipal sewage and wastewater is often used for small-scale irrigation, especially for growing vegetables that thrive on nutrient-rich sewage, but that poses serious threats to human health. In some countries, particularly water-scarce countries of West Asia and the Mediterranean, treated wastewater is used as a source of water, usually for irrigation. Depending on the effectiveness of the treatment, such uses can be safe, although there are concerns that food crops could be contaminated if the treatment is not fully effective and reliable.

Box 5
Water quality crisis in China

In only 6 of China's 27 largest cities does drinking-water quality meet government standards. Groundwater does not meet standards in 23 of those cities. Water bodies near urban areas are generally the most severely polluted, and the situation is getting worse. Major threats to water quality stem from inadequate treatment of both municipal and industrial wastewater. In 1995, China discharged over 37 billion cubic metres of wastewater, not including wastewater from township and village enterprises. More than 90 per cent of urban river segments monitored are polluted to the extent that the water is unsuitable for human contact; and more than half do not meet the lowest Chinese surface water standards, meaning that the water is not even suitable for irrigation.

Source: Compiled from information provided in *World Resources 1998-99*, World Resources Institute/UNEP/UNDP/World Bank, and UNDP, China's National Human Development Report 2002.

29. By and large, in developing countries, water-quality control has not received adequate attention in development programmes. Progress has been especially slow in the treatment of municipal and industrial wastewater because of its capital intensity, limited availability of financial resources, weak institutional capacities, limited public awareness and demand, and poor payment capacities of consumers. Both the precautionary and the polluter-pays principles are widely endorsed by Governments, but enforcement of water-quality regulations and standards remains constrained by lack of resources and poor governance.

IV. Integrated water resources management

A. Water management

30. Water use has conventionally been considered in three categories: agricultural use, industrial use, and municipal use, which includes household drinking water. In recent years, increasing attention has been paid to a fourth category, the water requirements of natural ecosystems including rivers, lakes and wetlands, which provide valuable economic and social services such as fisheries, biodiversity, water purification, transportation and recreation. Globally, about two thirds of extractive water usage is for agriculture, about one quarter for industry, and about 10 per cent for municipal use. Most water used for agriculture is consumed by crops or lost to evaporation, while almost all the water used by industry and households is returned to water bodies after use, though often in polluted form. Dams and reservoirs for hydropower, water storage and flood control store water temporarily, affecting other uses of water.

31. Integrated water-resources management involves allocation of water among those competing uses, and among users within each sector, promoting productive and efficient use of the water, and protecting water quality, so as to promote long-

term economic growth, social development and environmental protection. The Johannesburg Plan of Implementation calls for the development of integrated water-resources management and water-efficiency plans by 2005. While there are indications that many countries are working on those issues, there are no adequate criteria or information to assess progress towards the target.

32. In developing countries, most water — 70 per cent to 90 per cent — is used for agriculture, and the development of water resources for irrigation has been a major factor in the growth in food production per capita in recent decades. Agricultural water use is expected to increase by about 14 per cent between 2000 and 2030, a slower rate than in the past, and slower than population growth.[19] Increasing water supplies for irrigation will be more difficult as the easiest sources have already been developed, and there are now greater concerns over the social and environmental impacts of dams. Further growth in agricultural production will therefore depend more on increasing agricultural productivity with respect to both land and water.

33. Average irrigation efficiency[20] remains low in many developing countries, ranging from 25-40 per cent for the Philippines, Thailand, India, Pakistan and Mexico, to 40-45 per cent in Malaysia and Morocco. Those figures are below what can be achieved; average figures for Israel and Japan, for example, range from 50-60 per cent. Even modest savings in agricultural water use could contribute substantially to meeting the smaller but growing water demands for industrial or household use. For example, an improvement in irrigation efficiency in the Abyan-Tuban delta of Yemen from 45 per cent to 60 per cent could result in an annual saving of 65 million cubic metres of surface water that is at present used in spate irrigation.[21] In many countries, large subsidies of irrigation water continue to undermine efforts to improve water efficiency.

34. Still, water productivity in agriculture has generally been improving as a result of institutional and policy reforms, more proactive research and extension systems promoting efficient water-management practices, and improved irrigation technologies. There is a great potential for further increasing agricultural water productivity by reducing water losses in irrigation systems, improving on-farm water-management practices, implementing demand management measures, improving operation and maintenance of the infrastructure, and shifting to less water-intensive crops.

35. Many countries are working to increase water productivity in agriculture. Water sector reform following the political change in South Africa, for example, has prioritized agricultural water demand management. In Indonesia, the main thrust of the water-reform process has been to increase agricultural productivity and improve the performance of irrigation, based on participatory management, developing and strengthening water-user associations, and facilitating access to agricultural support services and microcredit. In many areas, particularly in Asia and North Africa, rehabilitating irrigation waterways, reclaiming waterlogged and salinized lands, and recapturing lost storage capacity of reservoirs by dredging remain the biggest challenges.

36. A growing number of countries have been transferring the management of local irrigation subsystems to the farmers who use them, with the government usually retaining ownership of the infrastructure and management of the main system. In most cases, such management transfer reduces the costs of operation and maintenance, improves collection of water charges, increases water use efficiency,

makes water distribution more equitable among users, and improves responsiveness (see Box 6). In Mexico, for example, recovery of operating and maintenance costs increased from 30 per cent to 80 per cent after the government transferred management of irrigation systems to user associations. In Egypt, cropping intensity nearly doubled in farmer-managed irrigation systems, and water-user associations were able to reduce some environmental impacts, such as the salinity level in runoff. Those transfers of responsibility often occur in conjunction with reduction or elimination of government subsidies, resulting in increased water charges to farmers. That may pose financial difficulties for them, but also promotes more efficient use of the water.[22]

Box 6
Women's involvement in irrigation management

A study in Dakiri, Burkina Faso, shows that allocating smaller plots to men and women separately instead of allocating larger plots to household heads has produced both higher yields and social benefits. When both men and women have irrigated plots, the productivity of irrigated land and labour is higher than in households where only men have plots. Women are equally good or even better irrigation farmers than men. With increased incomes, women have become economically less dependent upon their husbands, and can support their families and increase their own opportunities for individual wealth accumulation in the form of livestock.

Source: Adapted from United Nations, *World Water Development Report*, 2003, p. 217.

37. Countries in South Asia have implemented extensive irrigation-improvement programmes ranging from lining of main canals to cooperative management of shared watercourses. High capital requirements constrain progress, however. Adoption of modern water-saving technologies has been slowed by limited borrowing and repayment capacities of farmers, while credit programmes to promote these technologies have been hampered by inadequate governance mechanisms.

38. In many countries, demand management measures have proven successful in conserving water resources. Both developed and developing countries have reduced subsidies for irrigation water and increased cost recovery to improve the financing of water supply and improve efficiency (see Box 7).

39. Despite efforts to improve water efficiency in irrigation, scarce water is still often used for water-intensive, low-value production at the expense of uses that would contribute more to economic and social development. Changing water allocations, however, has proven difficult in many countries. In considering proposed irrigation projects, Governments often do not give adequate consideration to economic, environmental and social sustainability in the context of integrated water-resources management.

Box 7
Reducing demand through water pricing in Sydney

Although Sydney has experienced steady population growth for a number of decades, water consumption has been relatively stable at around 600 million cubic metres per year over the last 20 years, as the average amount of water consumed per person has declined. One of the key factors contributing to this decrease has been the changes in water pricing over the last decade — particularly the introduction of usage-based pricing.

Source: http://www.sydneywater.com.au/html/environment/tsr/csgrp013.html

40. In many areas, particularly in Asia, poor management of irrigation has resulted in land degradation, reducing productivity or even rendering land entirely unsuitable for agriculture. Globally, about 20-30 million hectares of irrigated lands are severely salinized and an additional 60-80 million hectares degraded to some extent by waterlogging and salinity.[23] An example of effective physical and demand management measures in addressing land and water degradation is the Murray-Darling basin in Australia (Box 8). In another case, countries of the Nile Basin, with coordinated support by donors, are developing the "Shared Vision Programme" to create a coordination mechanism and an enabling environment for the implementation of water-management projects. On the other hand, delays in the implementation of planned initiatives in the Niger River Basin in West Africa are causing further damage to ecosystems and threatening the sustainability of many poor rural economies.

Box 8
The Murray-Darling Basin in South Australia

Australia is the world's driest inhabited continent. The Murray-Darling River Basin symbolizes the water crisis it faces. It has been two years since the Murray River flowed into the sea. Between 50 per cent and 80 per cent of the wetlands in the basin have been severely damaged or completely destroyed, and dryland salinity threatens some 6m hectares of Australia's best farmland by 2050. The problems stem largely from high rates of water extraction and inefficient use for agriculture, encouraged by low water prices and overallocation of irrigation licences.

In recent years, the federal and state governments have been galvanized into action. Scientific studies have recommended increased flows to prevent the Murray's mouth from silting over, to restore endangered species, and to give remaining wetlands a chance of survival. Since the 1980s, community groups and governments have worked together — with some success — on implementing salt-diversion schemes and increasing dilution flows designed to lower river salinity. Then, in November 2003, following a large-scale community engagement process, a decision was made to return 500 million cubic metres per year to the river (still only a third of the 1,500 million cubic metres minimum requirement estimated by a group of leading scientists and environmentalists).

Source: compiled from various sources.[24]

41. Many small island developing States and coastal zones are faced with the problem of salt-water intrusion as freshwater is pumped out of aquifers in the coastal zone, where most of the population lives. In such areas, simple "scavenger well" technology for extracting water from thin freshwater layers on top of deeper saltwater[25] has shown positive results, for example in the Marshall Islands, but adoption of the technology has been slow owing to financial constraints.

42. In the case of water for hydropower, much of the potential in developing countries remains untapped. For example, sub-Saharan Africa and Central Asia are tapping only 17 per cent and the Asia-Pacific region only about 29 per cent of the economic hydropower potential and a much smaller share of technical potential.[26] That is in part because the locations of new resources and the demand for power are often poorly matched, with the further constraint of large capital requirements and environmental and social impacts. Dam sites on international watercourses may add further international complications.

43. Most developing countries are promoting development of their industrial sectors, often with serious implications for water pollution. Environmental regulations, including effluent standards, have not kept pace with industrial growth. In many developing countries, weak water governance and regulatory enforcement mechanisms have limited industry's incentive to invest in cleaner production technologies and wastewater treatment. While developing countries are not different in that respect from the currently developed countries during their own industrialization, they can benefit from the technological advances that have occurred in the interim which have improved the efficiency of input use, including water, and reduced material wastage, hence discharges to water and other media.

44. The sustainable management of international river basins is crucial for sustainable development. There are 59 international river basins in Africa alone, accounting for 80 per cent of the continent's surface water resources. International law has not progressed much in improving cooperation among riparian States. Many long-standing water-related disputes still remain unresolved, and the growing demand for finite freshwater resources heightens the risk of future conflicts. In OECD countries, the integration of upstream and downstream interests along transboundary water bodies is receiving increasing attention. In developing countries, the Mekong River Commission represents a long-standing mechanism for cooperation and coordination among riparian States, but the absence of key upstream riparians limits its effectiveness. Countries of the Nile Basin over the last decade have also been able to develop a common vision for efficient resource management and use.

B. Water policies and institutions

45. Lack of finance and institutional failure, exacerbated by increasing demand for water, have encouraged many countries to embark on reforms of their water sectors. The main thrust of those reforms has been to ensure better coordination in the water sector and encourage participation by major stakeholders. The results have been mixed. In some cases, decentralized management of water resources and services has yielded good results. However, failure of a large number of water-supply projects indicates the need for local decision-making in the choice of technology, as well as better coordination among donors.

46. New water laws enacted in various countries (e.g., Yemen, Madagascar, Brazil, Jamaica, Sri Lanka) are changing the rules of water governance, involving communities in water resource management and the development of sustainable water management policies. Over the years, different decentralization models have emerged. France, Morocco, Yemen, and Brazil have created water management structures to promote decentralized and participatory management at the basin level through basin committees. In several countries of South-East Asia (Thailand, Philippines, Indonesia and Malaysia), river basin organizations have been established to promote local ownership and participatory decision-making. In Kyrgyzstan, the break-up of the Soviet Union and the environmental issues surrounding the Aral Sea have prompted reforms with a focus on encouraging local management of water resources, improving on-farm water management practices, and transferring operation and maintenance responsibility to water user associations. Decentralization of service delivery, in some cases, has also promoted women's role in the provision, management and safeguarding of water resources, resulting in improved health and sanitation conditions for their families. However, experience also shows that decentralization of service delivery can be counterproductive in the absence of capacity-building programmes at the local level.

47. Successful policy and institutional reforms have led to better water allocation, financing and management in some countries. In Mexico, legal and policy changes have laid strong foundations for building stronger water-sector institutions. Chile has recently introduced legal and policy changes to address conflicts over water rights, for example between agriculture, hydropower and other uses. The main thrust of Brazil's policy reforms has been formulation and implementation of region- and sector-specific strategies, including the establishment of a water resources management authority. Morocco and Yemen have created river basin agencies and granted autonomy to public urban water supply agencies. While there is much diversity in those institutional and policy changes, similarities include the increasing importance attached to market-based allocation, stakeholder involvement, private sector participation, integrated water resources management, and economic and physical sustainability of water-supply systems.[27]

48. Managing water resources for sustainable development requires the collection, interpretation and application of data and information on water resources. In most developing countries, databases are inadequate, both quantitatively and qualitatively, not adequately characterizing either the baseline conditions or the trends. In too many places, water resource monitoring networks are deteriorating and some are not operational, basic data on water usage is not collected regularly, and conditions of supply systems have not been assessed. Reliable information systems on water require financial resources, a requirement that has not received sufficient attention from Governments and their development partners. The result of poor data is poor planning and programming. Besides lack of information on water quality and availability, the national reports submitted for the Commission on Sustainable Development point out the following major obstacles to integrated water resources management: lack of financial resources; insufficient coordination among authorities; and overlaps and inconsistencies between national and local legislation.

49. At the global level, the Global International Waters Assessment[28] — a programme led by UNEP and funded about 50 per cent by the Global Environment Facility (GEF) — uses an ecosystem-based approach to identify priority issues and policy responses for pollution mitigation and management of international waters at

the national and regional levels. Global International Waters Assessment promotes the sustainable use and integrated management of aquatic resources by presenting possible policy responses needed for alleviating problems in the 66 transboundary water regions.

C. Protecting aquatic ecosystems

50. Protection of aquatic ecosystems is critical to sustainable development because such systems provide valuable economic and social services such as water purification and fish spawning, as well as protecting biodiversity resources. A recent study[29] concludes that freshwater ecosystems have been hit hard by reduced and altered river flow patterns, by deteriorating water quality, by infrastructure construction and by land conversion. As a result, aquatic biodiversity and fisheries dependent upon aquatic ecosystems are in global decline.

51. Current water consumption patterns are harming aquatic biodiversity and the people whose livelihoods depend on the services that aquatic ecosystems provide. In some major water basins, for example the Murray-Darling basin in Australia, the Orange River basin in South Africa, and the Huang He basin in China, almost all the available flow is being withdrawn for human use. In the case of the Huang He River, the duration of low-flow periods in the lower parts of the river increased from 40 days in the early 1990s to 200 days in 1997, and at times no water reaches the sea at all. That has placed enormous stress on more than 100 million people in the basin, undermining their capacity to grow crops, as well as taking a toll on freshwater species and habitats.

52. Half the world's wetlands have been lost in the past century, and many freshwater species are facing rapid population declines or extinction. The Aral Sea has been one of the world's worst ecological disasters — its area reduced from more than 65,000 square kilometres to about 28,500 square kilometres in 1998, with a 75 per cent decrease in volume and greatly increased salinity. In many countries, the impact of land-based pollution on coastal areas has been far-reaching, triggering algal blooms, damaging reefs, and hurting fisheries. Of the world's fish species, most of which are from inland waters, only about 10 per cent have been assessed, and 30 per cent of those are listed as threatened. Even in OECD countries, the considerable water management efforts of recent decades have not been enough to safeguard and restore water quality and aquatic ecosystems.[30]

53. Despite these worrying trends, there is considerable evidence of promising changes in many countries. Most of the 72 countries submitting national reports under the Biodiversity Convention indicate they are gathering information on inland water biodiversity and undertaking actions towards conservation and sustainable use of inland water ecosystems, and capacity-building measures.

54. The principle of "payment for environmental services" is receiving increasing attention in environmental policies and is being tested in many countries. Costa Rica's payment for environmental services system — one of the most elaborate in the developing world — pays landowners for maintaining forests that provide water services such as flow regulation and purification. In Colombia, many water user groups pay for watershed services — sometimes by buying portions of the upper watershed.

D. Disaster prevention and management

55. A total of 2,200 major and minor water-related disasters occurred in the world in the period 1990-2001: 35 per cent in Asia, 29 per cent in Africa, 20 per cent in the Americas, 13 per cent in Europe, and about 3 per cent in Oceania. A total of 1.5 billion people were affected by floods around the world between 1991 and 2000, while economic damages due to floods in 2002 were estimated to be over $30 billion.[31] Factors that explain the increasing frequency and costs of disastrous flooding include deforestation, demographic shifts, changing land-use and human settlement patterns, and changing weather patterns. In Asia, where the majority of recent large floods have occurred, deforestation and urbanization in the 1990s increased the risk and severity of floods. In Thailand, land use changes caused a reduction of natural water storage and retention in the lower Chao Phraya River Basin, which flows through Bangkok, increasing flows by up to 3,000 cubic metres per second.

56. Nonetheless, there have been technical improvements arising from better understanding of the causes of water-related disasters, including better tools for short- and long-term forecasting and prediction, and better monitoring and modelling of disaster-related factors. There has also been increasing emphasis on reducing vulnerability to disasters. Still, disaster risk reduction is not fully integrated into development strategies and development assistance. The General Assembly adopted the International Strategy for Disaster Reduction (ISDR) disaster risk reduction as an integral part of sustainable development. The issue of human settlement development in disaster-prone areas is addressed in the report of the Secretary-General on human settlements.

V. Means of implementation

A. Finance

57. Current spending on new water infrastructure in developing countries is roughly $75 billion a year,[32] including investments of about $13 billion per year for drinking water supply. While the majority of people without access to improved drinking water live in rural areas, especially in Africa and Asia, it is the urban sector that has benefited most from investment in drinking water supply. In the 1990s, average annual investment in urban water supply in developing countries was $8 billion, compared to $4.6 billion in rural areas.[33] Out of the total annual investments of $15.7 billion in water supply and sanitation (1990-2000), water supply received about 80 per cent with only 20 per cent spent on sanitation, and in Africa, only 12 per cent.

58. Rapid urban population growth over the coming decade (representing an estimated 87.5 per cent of world population growth, occurring overwhelmingly in developing countries[34]) means that there will be a continued need for sizeable investments in urban water infrastructure. At the same time, given the already high urban coverage rate, the large rural-urban gap in coverage rates, and the wide disparity between water coverage and sanitation coverage, there is a case for rebalancing priorities towards rural water supply and towards sanitation generally and, particularly, in urban and peri-urban informal settlements.

59. Based on the estimated per capita costs of supplying drinking water in developing countries over the past decade, and considering that an additional 1.6 billion people will need access by 2015 to meet the drinking-water-related Millennium Development Goal, an annual average of roughly $26 billion will be needed to extend water-supply coverage over the next 11 years (including annual operating and maintenance costs assumed to be 15 per cent of investment costs). Meeting the target for sanitation could cost substantially more if wastewater treatment costs are added to those of basic sanitation infrastructure (see discussion in the report of the Secretary-General on sanitation). Global estimates of investment requirements are uncertain, however, being sensitive to assumptions about technology mix and location of population to be served. More attention needs to be given to generating reliable country-specific estimates.

60. Domestic resource mobilization for irrigation development has proven difficult owing to inadequate water-pricing policies. Irrigation water remains highly subsidized. However, there is increasing recognition of the need to price water to recover at least a significant proportion of system operation and maintenance costs. Essential complements to water pricing are water distribution rules and technological improvements in water-delivery systems to enable farmers to conserve water in response to higher prices.[35] Commercial loans and private investment in irrigation infrastructure have both declined in recent years, while development costs for new irrigated land have increased markedly. For instance, costs have increased more than 50 per cent in the Philippines, 40 per cent in Thailand, and have nearly tripled in Sri Lanka owing to high costs associated with land development and reclamation, water transfers, water distribution networks, and high pumping costs in the case of groundwater irrigation.

61. A major issue in the management and development of drinking water supply systems in recent years has concerned the role of the private sector and public-private partnerships. Private sector participation in drinking-water supply can be considered in two broad classes. The first involves large private companies — frequently multinationals. There are four broad types of large-scale private participation involving different distributions of investment risk: management and lease contracts (where the facility remains in public hands and investment decisions and financial responsibilities remain with the public sector), concessions (involving temporary takeover of management of a public utility and some investment commitment), greenfield investment in new facilities (with possible reversion of ownership of infrastructure to the public sector), and divestiture (where the private investor buys an equity stake in the state enterprise).[36] The second involves small-scale water providers engaged primarily in the provision of services and making only limited investments (e.g., in water tanker trucks, pumps, boreholes).

62. Large-scale private sector participation in water and sewerage is heavily concentrated in East Asia and the Pacific and Latin America and the Caribbean (table 3), and water projects predominate over sewerage. In South Asia and sub-Saharan Africa, private investment is virtually non-existent. In each region, some countries have emerged as leaders in terms of attracting private sector investment — including China and Malaysia in East Asia; Mexico, Brazil and Argentina in Latin America; and Morocco in North Africa. Establishment of effective institutions, implementation of legal and regulatory frameworks, and improved governance mechanisms in those countries have paved the way for private sector participation. Of the 238 projects listed in the table, 40 per cent are concessions and roughly one

third greenfield investments, fewer than 10 per cent represent divestitures of publicly owned enterprises. The relative weights of different types of participation are broadly similar across regions, though in East Asia and Pacific greenfield investments are almost as numerous as concessions and in Europe and Central Asia management contracts dominate.[37]

63. Problems that have arisen with private water companies include collusive bidding on water-supply contracts, regulators who are too readily influenced by regulated companies, inflexible contractual guarantees of returns, monopolization of essential infrastructure, and lack of transparency. More generally, doubts have been raised about the realism of the expectation that large-scale private sector participation in the water sector will make more than a minor contribution towards meeting the water-related Millennium Development Goal.[38] Only a small fraction of the world population is currently served by private providers.[39] In recent years, private investors have become more cautious and slowed investments in the water sector, having underestimated risks, overestimated profits, and encountered contractual problems — e.g., as Governments have at times sought to renegotiate contracts in the face of public discontent over water charges.

Table 3
Private sector investment in water supply and sewerage projects, 1992-2002

Region	*Number of projects*	*Investment with private participation (in millions of US dollars)*
East Asia and the Pacific	73	14 643
Europe and Central Asia	39	2 682
Latin America and the Caribbean	105	15 378
Middle East and North Africa	7	1 209
South Asia	1	216
Sub-Saharan Africa	13	67
Total	**238**	**34 195**

Note: Investment figures include private and public contributions.

Source: Private Participation in Infrastructure (PPI) Project Database, World Bank; http://rru.worldbank.org/PPI/about.asp.

64. In view of the apprehension about granting a local monopoly of water supply to a private company and, in particular, concerns over the social impact of increases in water charges, Governments and consumers in many developing countries have not encouraged participation by multinationals in the provision of water services. The debate in different forums has contributed to a better understanding of the potential role of the private sector, although not to a consensus on all the issues. Governments increasingly recognize that private participation need not (indeed does not) involve private ownership of the resource nor even of infrastructure (and where it does, contractual terms can make such ownership temporary). More commonly, what is involved is private management of a public utility (with varying degrees of investment risk sharing). They also appreciate the need for a strong regulatory framework to ensure that private investor behaviour — e.g., with respect to tariff setting — is consistent with the public interest. In short, private sector participation

implies a dialogue between the government, the private sector and user representatives to develop socially, economically and environmentally sound solutions to the problem of extending access to safe and affordable water.

65. The role of small-scale water providers in supplying water services can be quite substantial but has not been well documented. The small-scale water provider sector covers a wide range of water service provider types. A recent survey[40] in six African, eight Asian and six Latin American and Caribbean cities found the following arrangements: small-scale water provider partnership with the water utility; small-scale water providers providing water from their own sources (e.g., private wells) to neighbourhoods not covered by utilities; entrepreneurs who build their own systems connected to the utility mains; owners/operators/franchisers of public toilets and bathing facilities; water kiosk and standpipe operators, who are the most common providers to the urban poor.

66. A recent study by the Asian Development Bank[41] estimated that roughly 20-45 per cent of households in cities such as Cebu (Philippines), Ho Chi Minh City, Jakarta and Manila rely on water-supply services provided by small-scale water providers. In Tegucigalpa, Guatemala City, and Lima, more than 30 per cent of supply is provided by small-scale water providers.[42] Most of those consumers are not connected to the main distribution networks. The small-scale water provider market is in general quite competitive in terms of delivering services. The higher prices charged by small-scale water providers than by water utilities can reflect a combination of factors: loss of economies of scale, subsidies for piped water, greater flexibility and convenience (e.g., no connection charges), and in some cases a local monopoly on a bulk water source. In some cases, it may be a public water utility that exercises that monopoly, earning a higher return — albeit on a smaller volume — from selling water to small-scale water providers than from delivering it through the piped network. On occasion, that can give rise to abuse, e.g., when intermittent service interruptions force even network customers to buy from small-scale water providers. Still, as long as publicly or privately owned water utilities bypass wide swathes of human settlements — notably urban informal settlements, the small-scale water providers will continue to fill an important need.[43]

67. In many countries of South Asia (including India, Pakistan and Bangladesh), the local private sector plays an important role in promoting the use of hand pumps for extracting groundwater, making the pumps available at affordable prices and adapting them to local needs and preferences. On the other hand, in most African countries, pumps were introduced through donor-driven programmes, lacking national or local ownership, and the result was absence of standardization of equipment and maintenance procedures. The local private sector lacked the entrepreneurial and technical capabilities to tailor that technology to local needs.

B. Capacity-building

68. Considerable progress has been made over the last decade in terms of institution building and the development of policy and regulatory frameworks for water resources management, also in strengthening capacities of local enterprises and communities in different aspects of water resource management and service provision. Good results have been achieved in human resources development and

the transfer of technical skills, but there has been limited success in creating sustainable organizations and institutions.

Box 9
Improved water accounting in Morocco

Morocco has recently launched a water accounting project in the Oum-Er-Bia River Basin in partnership with the United Nations Department of Economic and Social Affairs with the intention of progressively developing accounts for all river basins in the country, and of integrating the results into the national accounts. More than 30 national and basin-level institutions are participating in that exercise, coordinated by the National Statistical Office, with assistance from ministries dealing with water, environment and land-use planning. Integrating the social dimension into the accounts is being studied. The end result is expected to be strong coordination among national institutions and a solid information base for rational policy-making.

69. Water sector institutions generally remain weak and underfunded, although they have developed during the last decade in terms of their capacities to contribute to water legislation, water policy, and water administration. While past achievements were associated mainly with investment in new physical structures, recent developments in the water sector are associated with improved management and institutional changes. A common problem in implementing institutional reform is that the water sector is large and diverse and responsibility for it is fragmented, or at least divided among several agencies. Considerable problems still remain with resolving competing demands for water from different sectors and with allocation of rights. Increasing competition between demands for irrigation and urban water, in particular, has brought the need for national integrated water management into sharper focus in recent years, likewise the greater appreciation of the value of various in situ benefits provided by freshwater resources, including maintenance of ecosystem integrity.

70. The sustainability of capacity-building activities in developing countries remains a major source of concern due to lack of adequate funding and political commitment. Collection of information and data for water management is often dependent on project activities; once the project is completed, data collection activities are abandoned. Observation networks and evaluation of basic hydrological phenomena that should serve as the basis of water resources policy have deteriorated in many parts of the world over the past decade. Poorly motivated, low-paid government staff are frequently a major constraint to strengthening technical and institutional capacities. Targeted needs assessments and demand-driven approaches are crucial to secure sustainability. Evaluation of the UNDP Capacity 21 programme has concluded that capacity development is an endogenous process, which cannot be imposed or replaced by outside interventions.[44]

VI. Continuing challenges

71. The preceding sections identify some important challenges and issues that need to be addressed to achieve the internationally agreed targets relating to water. Most of them have been recognized before in international forums, but two factors make it important to review them again. First, access to drinking water has moved higher on the international agenda and is now recognized as a "basic human right".[45] Secondly, with 2005-2015 declared by the General Assembly as the International Decade for Action, "Water for Life", the twelfth session of the Commission on Sustainable Development provides an important opportunity for the international community to understand better the lessons learned and to impart a new impetus to implementation.

72. *Providing access to safe drinking water.* Increasing access to safe drinking water and sanitation is imperative to help prevent the large number of deaths and illnesses each year attributable to water-related diseases, to reduce poverty, and to achieve sustainable development. The most critical issues that need to be addressed to meet that challenge include: better targeting of subsidies to ensure that the very poor are the prime beneficiaries and to reduce the fiscal burden; devising tariff structures — e.g., lifeline rates — that ensure universal affordability of at least the minimum quantities needed to support life and health; mobilization of resources and expansion of infrastructure with more focus on rural and peri-urban areas and with an emphasis on low-cost technologies; rehabilitation of existing water systems; and promoting private sector participation and investment in the provision of affordable services. Access will have to be sustained through improved local governance and regular operation and maintenance (O&M) of the systems.

73. *Maximizing economic and social benefits from available water resources.* Increased water productivity in all sectors and allocation of scarce water taking into account its value in different uses is an important challenge for promoting sustainable development. Experience suggests the need for greater cost recovery in water pricing, supported by improved water administration and governance mechanisms.

74. *Improving water quality.* In many countries and water basins, particularly in developing countries, water pollution from household wastewater, industrial effluent and agricultural runoff is on the rise, posing serious threats to human health, ecosystems, and economic activity. Growing industrial sectors have been lagging in introducing cleaner production technologies, and wastewater-treatment facilities are often absent or non-functional. The political will and incentives to enforce existing laws and regulations remain weak in many countries. Concerns over the costs to industry of pollution control often take precedence over the internalization of the social costs of pollution. Resources are generally inadequate for regular and accurate water-quality monitoring. Experimentation is only beginning in most places with the use of economic instruments to reduce the costs of achieving water-quality objectives.

75. *Practising integrated water resources management.* Many of the problems facing the water sector are due to poor implementation of the principles of integrated water resources management. While countries agreed at the World Summit on Sustainable Development to prepare integrated water resources management and water efficiency plans by 2005, with support to developing

countries, the implementation of that goal requires coordinated action on several fronts. Efforts are needed to improve the quality of databases and information systems, including water accounting systems. Fragmented institutional structures with overlapping mandates and inadequate legislative and policy frameworks are important impediments to integrated water resources management. An equally important challenge is to foster dialogue among riparian States for efficient management and utilization of international waters. Action plans to minimize the impact of water-related disasters deserve priority in national planning processes.

76. *Improving agricultural water productivity*. Providing enough water to produce food is an enormous challenge, especially in those countries where water is scarce. Therefore, substantial increases in productivity will have to be achieved, requiring both stronger incentives to water conservation in agriculture and investments in modernization of existing irrigation systems. Agriculture will have to be able to release water to other, high value uses while at the same time ensuring water accessibility and affordability to poor farmers.

77. *Protecting ecosystems*. There is continued neglect of water requirements for maintaining valuable ecosystems in terms of both quantity and quality. Institutional and policy reforms that could help to improve the situation include delineation and validation of property rights of communities and institutions charged with conserving ecosystem functions, together with the further development and wider application of the concept of payment for ecological services.

78. *Mobilizing financial resources*. The country reports submitted to the Commission on Sustainable Development indicate that lack of financial resources is a major impediment to achieving the water and sanitation targets. The main obstacles to mobilizing resources are: inadequate domestic resource mobilization policies, insufficient flow of ODA to developing countries, and lack of private sector investment. Donor coordination at the country level, especially among the United Nations agencies through a well-structured mechanism, will be critical to providing an integrated and cost-effective response to the needs of member States in implementing the international water-related goals and targets.

79. *Strengthening institutional and technical capacities*. Experience suggests that sustained capacity-building efforts will be critical to achieve the internationally agreed targets. That will require increased budgetary allocations, including support from international donors. Monitoring and assessment capacities need to be kept operational. Also, the best-designed water management policies and programmes fail when implementation and enforcement capacities are weak. Apart from technical training, for example in water supply system operation and maintenance, training would be useful in the design of effective incentive mechanisms to encourage enforcement of water pollution laws and regulations.

Notes

[1] WHO/UNICEF, Global Water Supply and Sanitation Assessment: 2000 Report.

[2] http://www.wssinfo.org/en/122_definitions_en.html.

[3] See note 1.

[4] WHO (2000), cited by Gleick et al. (2002). The World's Water 2002-2003: The Biennial Report on Freshwater Resources, Island Press.

[5] Saghir, J., M. Schiffler and M. Woldu (1999). World Bank Urban Water and Sanitation in the Middle East and North Africa Region. The Way Forward, World Bank.

[6] CIMA Report (2003). Drinking Water Supply in Rural Niger, Report Prepared for the AfDB.

[7] Government of Pakistan (2002). Pakistan Water Sector Strategy, Ministry of Water and Power.

[8] World Population Prospects, the 2002 Revision, United Nations Population Division.

[9] This assumes no major disruption to precipitation patterns that might result, e.g., from global climate change. Gould, J. (1999). Assessment of Water Supply Options: Contributions Relating to Rainwater Harvesting, World Commission on Dams, October.

[10] For instance, in Manila vendor-supplied water costs 14-33 times piped water per cubic metres while in Delhi it is 6-10 times more expensive; McIntosh, A. C. (2003), "Asian Water Supplies Reaching the Urban Poor", Asian Development Bank, Manila. In many instances, however, competition limits the price differential vendors can charge.

[11] International Food Policy Research Institute/International Water Management Institute (2002). World Water and Food to 2025: Dealing with Water Scarcity.

[12] OECD (2003). Social Issues in the Provision and Pricing of Water Services. The OECD Environment Programme.

[13] Argentina, Bolivia, and Chile; Foster (2002), "Ten Years of Water Service Reform in Latin America: Towards an Anglo-French Model", in P. Seidenstat, D. Haarmeyer, and S. Hakim, eds., *Reinventing Waste and Wastewater Systems: Global Lessons for Improving Management*, John Wiley and Sons, Inc., N.Y., cited in Box 9.5 of *World Development Report 2004*, Chapter 9, The World Bank, Washington, D.C.

[14] World Bank (2001). Privatization and Basic Infrastructure Services for the Urban Poor.

[15] WHO (2003), *The World Health Report 2003*, Geneva.

[16] For the Seine and the Tokyo area, see *Water for People, Water for Life: The United Nations World Water Development Report*, UNESCO, 2003. For the Rhine, see www.thewaterpage.com/rhine-environment.htm. For the Danube, see www.icpdr.org.

[17] Barlow, M. (1999). "Blue Gold: The Global Water Crisis and the Commodification of the World's Water Supply". A Special Report issued by the International Forum on Globalization.

[18] Some 1.5-2.5 million tubewells are estimated to be contaminated with arsenic by the Bangladesh standard of 50 µg per litre and some 35 million people are estimated to be exposed to an arsenic concentration in drinking water exceeding that standard, 57 million to a concentration exceeding 10 µg per litre, the WHO standard; British Geological Survey Report WC/00/19 Vol. 1, *Arsenic contamination of groundwater in Bangladesh*; http://www.bgs.ac.uk/arsenic/bphase1/b_intro.htm.

[19] FAO (2002). "World Agriculture: Towards 2015/30", Rome.

[20] Irrigation efficiency is defined as the net irrigation water requirements, minus effective rainfall, divided by the volume of water diverted from water sources. Alternatively, it is also defined as the product of water application efficiency and water delivery efficiency.

[21] United Nations Department of Economic and Social Affairs/National Water Resource Authority, (2003). Sustainable Water Resources Management Project. These savings could be used to complement the Aden water supply, thus relieving stress on groundwater resources, as well as preventing further inland movement of the saltwater intrusion front. Under spate irrigation, floodwater from mountain catchments is diverted from river beds (wadi's) and spread over large areas. Substantial local wisdom has developed in organizing spate systems and managing both the floodwaters and the heavy sediment loads that go with them.

[22] Vermillion, Douglas. "Impacts of Irrigation Management Transfer: A Review of the Evidence", Research Report No. 11, International Irrigation Management Institute, Colombo, Sri Lanka, 1997.

[23] FAO (1996). Food Production: The Critical Role of Water, World Food Summit.

[24] Special Report in *Financial Times*, 9 December 2003, web site of the Murray-Darling Basin Commission: http://www.mdbc.gov.au/index.htm.

[25] Scavenger wells provide a more sustainable freshwater supply on islands or coastal areas where an underground layer of freshwater sits on a deeper layer of salt water, by using two pumps to balance saltwater and freshwater withdrawals.

[26] UNDP, United Nations Department of Economic and Social Affairs, World Energy Council (2000). World Energy Assessment.

[27] Saleth, R. and A. Dinar (2000). Institutional Changes in Global Water Sector, Water Policy (175-199).

[28] http://www.giwa.net/index.phtml

[29] Revenga, et al (2000). Pilot Analysis of Global Ecosystems: Freshwater Systems, World Resources Institute.

[30] OECD, Water Management Performance and Challenges in OECD Countries.

[31] *World Water Development Report (2003)*. United Nations World Water Assessment Program.

[32] GWP and WWC (2003). Financing Water for All: Report of the World Panel on Financing Water Infrastructure, Global Water Partnership and World Water Council, March. Estimates cover drinking water, sanitation and hygiene, municipal wastewater treatment, industrial effluent, agriculture, and environmental protection.

[33] See note 1.

[34] Based on table 4 of United Nations (2002), *World Urbanization Prospects*. The 2001 Revision, New York.

[35] Dinar, A., and J. Mody (2003). Irrigation Water Management Policies: Allocation and Pricing Principles and Implementation Experiences, *Natural Resources Forum*.

[36] Based on the typology contained in the PPI database of the World Bank: http://rru.worldbank.org/ppi.

[37] Based on the PPI database of the World Bank.

[38] Cf. J. Budds and G. McGranahan (2003), "Are the debates on water privatization missing the point? Experiences from Africa, Asia and Latin America", *Environment and Urbanization*, Vol. 15, No. 2, October.

[39] By one estimate, perhaps 10 per cent of water supply systems in the world are currently managed by the private sector; C. A. Linares (2003), "Institutions and the Urban Environment in Developing Countries: Challenges, Trends, and Transitions", Yale School of Forestry and Environmental Studies, New Haven, CT, July.

[40] Snell, S. (1998), "Water and Sanitation Services for the Urban Poor. Small Scale Providers: Typology & Profiles", Working Paper, UNDP/World Bank Water and Sanitation Program, Washington, D.C.

[41] A. C. McIntosh (2003). Asian Water Supplies: Reaching the Urban Poor (Chapter 7), Asian Development Bank, Manila.

[42] Solo, T. M. (2003). Independent Water Entrepreneurs in Latin America: The Other Private Sector in Water Services, Department of Finance, Private Sector and Infrastructure, Latin America Region, and Energy and Water Department, Private Sector Development and Infrastructure, The World Bank, Washington, D.C.

[43] One of the biggest challenges facing water regulatory bodies is how to monitor adequately the quality of water supplied by dozens or even hundreds of small-scale water providers.

[44] UNDP (2002). *Capacity 21 Evaluation Report (1993-2001)*, New York.

[45] On 28 November 2002, the United Nations Committee on Economic, Social and Cultural Rights adopted General Comment No. 15 on the right to water, referring to article 11 of the International Covenant on Economic, Social and Cultural Rights. The General Comment states that: "the human right to drinking water is fundamental for life and health. Sufficient and safe drinking water is a precondition for the realization of all human rights."